GENERAL ATOMICS AERONAUTICAL SYSTEMS, INC.

Remotely Operated Aircraft Systems

Predator B: The Multi-Role UAV

PREDATOR B

June 2002

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Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Predator® B

- Proven Predator technology
  - 40,000+ flight hours
  - Surveillance, targeting, and weapons delivery
- Applied to
  - Next generation Predator B
    - Goes faster
    - Carries more
    - Goes higher
    - Is more reliable
    - Redundant avionics
    - Flight safety features

Predator B

- Began as a company-funded internal research and development effort in 1998
- Design and build two versions
  - Turbo prop
    - Endurance 24 hr
    - Altitude 45,000 ft
  - Jet
    - Endurance 18 hr
    - Altitude 60,000 ft
  - First flight February 2001
- NASA added $10M beginning in 2000
  - Modified turbo prop
    - Endurance 32 hr
    - Altitude 52,000 ft

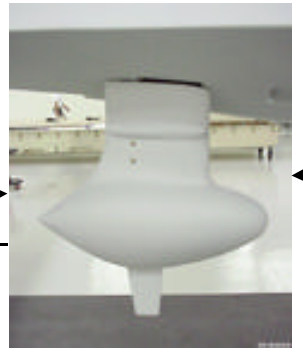
Predator B System

Remotely Operated Aircraft System

Line-of-Sight
Ground Data Terminal

Line-of-Sight Data Link
Satellite/Over the Horizon Data Link

Airborne Data Terminal



Command and Control

Video/Telemetry

Data

Aircraft Powerplant
and Control
Surface Actuators

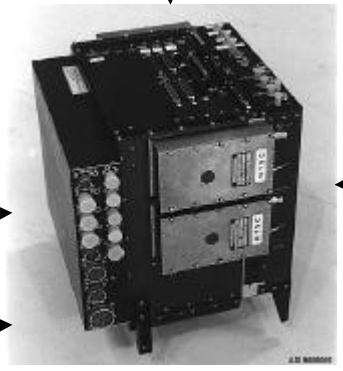
Video

RS
Digital
Data

Ground Control Station

Flight
Altitude
Sensors

Sensor
Data



Primary Control Module
(Data Link/Flight Computer)

The Next Generation Predator — Jet Power

- Increased mission flexibility
  - Reposition/retask quickly
  - Standoff for reconnaissance and strike support
  - SAR, EO/IR, ESM, and radio relay in one mission aircraft
- Increased reliability
  - Predator system
  - Jet engine MTBF over 150,000 hr
  - Redundant avionics
- Improved sensor equals increased standoff
  - Lynx™ SAR with 4 in. (.1m) resolution and zoom capability
  - Improved optics
    - Views personnel at 50 nmi (90 km)
  - ESM and radio relay
- Employment concept mirrors Predator
  - Similar logistics
  - Common control station
  - Shipping containers
  - C-130/A400M compatible

Predator B MQ-9A — Turboprop
Propjet #1 and #2 Delivered to United States Air Force

Configuration
- Length: 36 ft (10.8m)
- Span: 66 ft (20.1m)
- Predator avionics
- Common actuators
- Honeywell TPE-331-10t gas turbine
- Redundant flight control surfaces
- Long-life actuator motors

Performance
- 45,000 ft altitude
- 24 hr endurance
- 750 lb (340 kg) internal payload
- 3,000 lb (1,363 kg) external payload
- 3,000 lb (1,363 kg) fuel
- TOGW 7,500 lb (3,409 kg)

Demonstrated

50,000+ ft altitude

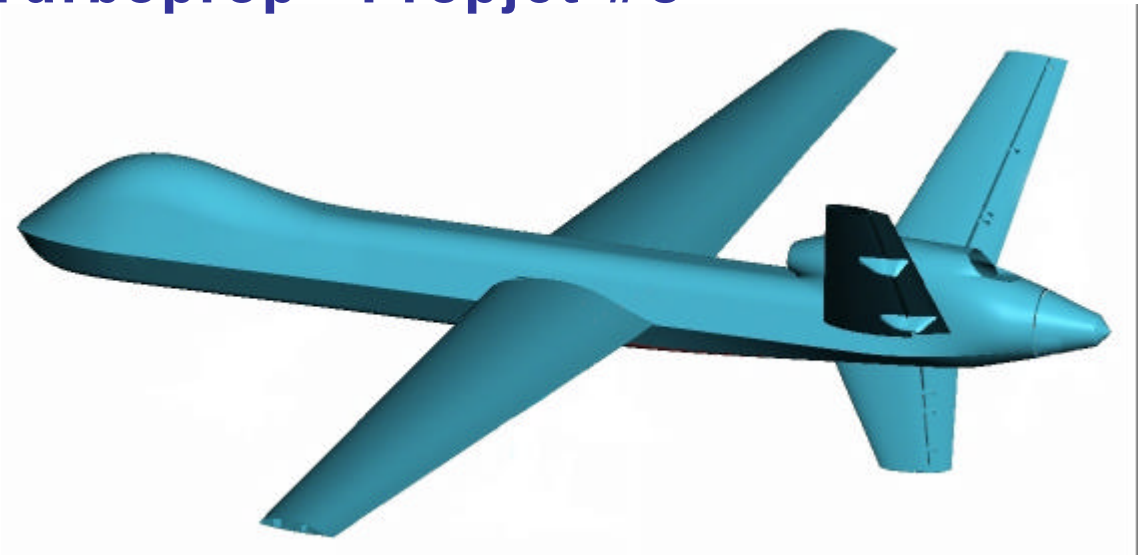
28 hr endurance

Altair™ — NASA Propjet

- Predator B “Enhanced”
- Length: 36 ft (10.8m)
- Span: 86 ft (26.2m)
- Triple redundant avionics
- Commercial 2,000 hr actuators
- Honeywell TPE 331-10t gas turbine
- ATC voice relay
- TCAS I (Terminal Collision Avoidance System)
- 52,000 ft altitude
- 32 hr endurance
- 660 lb (300 kg) internal payload
- 3,500 lb (1,591 kg) fuel
- TOGW 7,400 lb (3,363 kg)

- Science missions
- National airspace certification

Predator B MQ-9A — Turboprop - Propjet #3

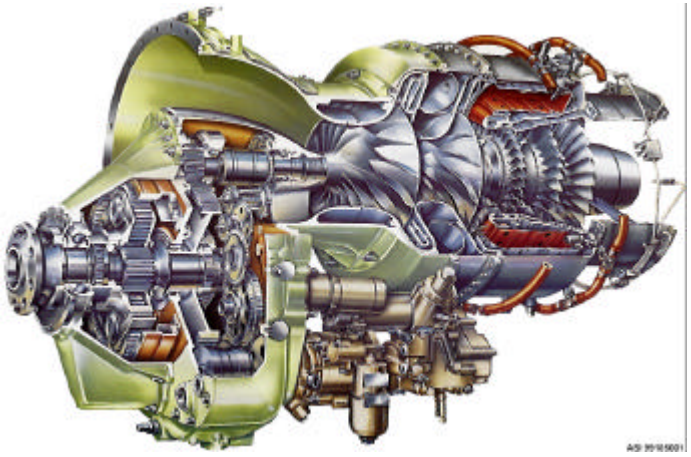


- Already ordered by USAF
- Production configuration
  - Length: 36 ft (10.8m)
  - Span: 66 ft (20.1m)
  - 32 hr endurance
  - Additional capability
    - Triple redundant avionics
    - Commercial 2,000 hr actuators
    - Increased fuel to 4,000 lb (1,818m)
    - 6 wing stations

Empty weight (Including 800 lb P/L in nose)	4,100 lb (1,863 kg)
Fuel capacity	4,000 lb (1,818 kg)
External stores capacity	3,000 lb (1,363 kg)
TOGW	10,000 lb (4,545 kg)

Propulsion — Turboprop

- Honeywell TPE 331-10t
  - 100 million fleet hours
  - 12,000 engines produced
- McCauley three-bladed propeller
- 525 lb (238 kg) engine + prop
- 940 takeoff SHP
- Operations over 50,000 ft MSL
- Currently operational on:
  - Metro Merlin
  - Turbo Commander
  - Other



MQ-9A Predator B

Predator B — Jet

- Identical to propjet
- Except for power plant
  - Length: 36 ft (10.8m)
  - Span: 66 ft (20.1m)
  - Williams FJ44-2A turbofan engine
  - Triple redundant avionics
  - Redundant flight controls
  - Commercial 2,000 hr actuators
- 18 hr endurance
- Empty weight
  - Including 800 lb (363 kg) P/L in nose - 4,100 lb (1,863 kg)
  - Fuel capacity - 4,000 lb (1,818 kg)
  - External store capacity - 3,000 lb (1,363 kg)
  - TOGW - 10,000 lb (4,545 kg)

Propulsion — Turbofan

- Williams International, FJ44-2A (modified) turbofan engine
- Medium bypass, two-spool, co-rotating, axial flow
- Evolved from FJ44-1A, over 500,000 fleet hours
- 2,300 lb thrust
- 520 lb (236 kg) basic engine weight
- Currently operational on:
  - Cessna Citation Jet
  - Raytheon Premier I

ASI 00105005

Predator B — Airworthiness Considerations

- Triple redundant flight computers
- Triple redundant flight sensor suites
- Dual redundant network to distributed processors
  - Servos and actuator drivers
  - Engine control system
- Dual redundant line-of-sight data link
  - Dual nose cameras, three antennae
- Dual redundant power system
  - Dual power bus to all flight critical units
  - Two generators plus batteries
- Redundant flight surfaces
  - 4 ailerons
  - 4 flaps
  - 4 ruddervators
  - 1 rudder

Predator B — Airworthiness Considerations (Cont.)

- Engine control system
  - Redundant command and control
  - Redundant fuel pumps
- Mode 3C transponder
- Air traffic control voice system
- All relevant flight data available real time in GCS
- Separation of flight computer from mission computer

Predator B — Payload

- Aircraft designed using a modular payload concept to facilitate quick and flexible integration of multiple payloads
  - Generic interface provides convenient “hooks” for power and data for multiple customized payloads
  - Large viewing ports provide sensors almost unrestricted access in both upper and lower hemispheres throughout nose payload bay
- External wing hardpoint locations with power and control available at each station

Summary

- The jet powered Predator B provides the next-generation reconnaissance/targeting system in a seamless transition from Predator
- Predator and Predator B provide a complimentary operational mix of aircraft systems that evolved from the same design logic, using a common ground control station and data links
- Predator B was developed from GA-ASI's extensive experience with Predators
  - Development is complete
  - Predator B entering active U.S. service as MQ-9
  - Altair being utilized for NASA missions
  - Ready to export

Summary (Cont.)

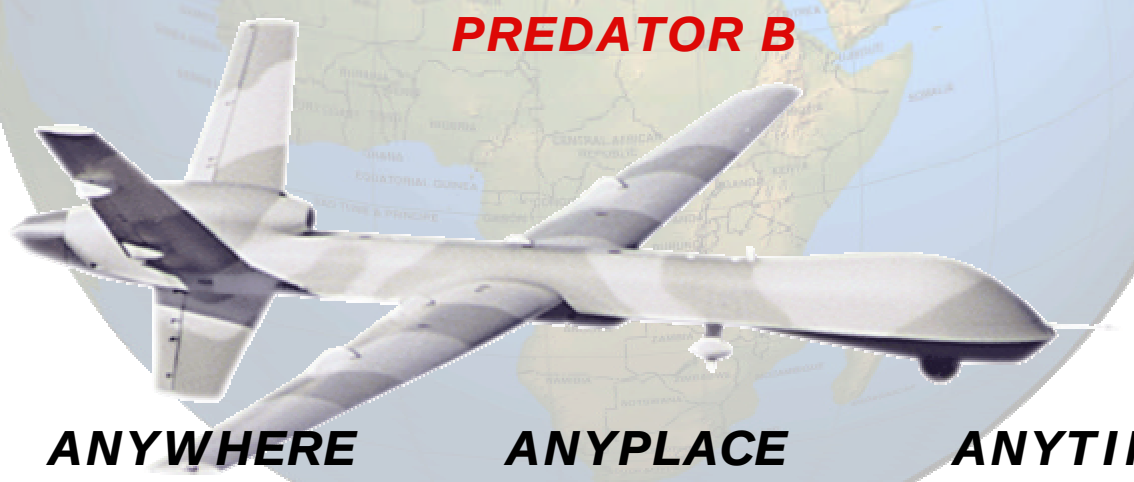
- A combat-proven flight and ground control system
  - Incorporated into a larger airframe
  - Powered by reliable commercial jet engines
  - Increased speed, altitude and payload capability
- Carries advanced sensors
- Requires minimum manning for planning and operations

THE PREDATOR SYSTEMS

A New Dimension In Worldwide Awareness

- Launch/Recover — From anywhere
- Control — From anywhere
- Distribute color TV and FLIR, radar, electronic surveillance products — To anyplace
- Launch precision weapons — Anytime

PREDATOR B



ANYWHERE ***ANYPLACE*** ***ANYTIME***